

REMARKS

Claims 1-9 were presented for examination. Claims 1-9 were rejected. Claim 1 has been amended. Claims 10-20 have been added. Accordingly, claims 1-20 are pending in the application. No new matter has been entered as support for the above amendments and new claims is provided for by the specification, drawings, and claims as originally filed.

Rejections Under 35 U.S.C. § 103(a)

Claims 1-9 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Vining et al in view of Summers et al. Applicant respectfully traverses.

Claim 1 recites a method of detecting abnormalities in digital imagery. A set of binary images derived from a plurality of slice images representing cross-sections through a body is provided. A first spherical summation operation is performed as a function of voxel locations in the set of images over a spherical region of a first radius to provide a first spherical summation value. A second spherical summation operation is performed as a function of the voxel locations in the set of images over a spherical region of a second radius to provide a second spherical summation value. A ratio of the first spherical summation value to the second spherical summation value is computed and the ratio is compared to a threshold value and a set of detection images is created by turning voxels ON which exceed the threshold value.

Vining discloses a system and method for automatically analyzing three-dimensional renderings of structures having lumens for potential abnormalities. However, Vining fails to teach the step of performing the spherical summation operations for *detecting* abnormalities. Instead, the sections cited by the Examiner in the office action as teaching this limitation, in fact, teach *displaying* the renderings of the images in different orientations in three dimensions (Col. 13, lines 17-34; Col. 14 line 60 through Col. 15, line 21. Instead, Vining teaches detecting lesions by convexity and curvature methods (Col. 2, lines 38-51; Col. 10, lines 22 through Col. 11, line 3; Col. 11, line 52 through Col. 12, line 17). In contrast, the claimed invention recites using

simple summation operations on two different spherical volumes of the binary images using two different radii for abnormality detection. Simple summation is used because it provides a degree of noise immunity. Additionally, the claimed invention specifically teaches away from using curvature calculations for detection because such calculations are more susceptible to producing spurious outputs due to noise in the imagery inputted to the detector. The reduction of spurious output results in decreased processing time in subsequent stages and potentially greater overall classification accuracy.

In addition, Vining also fails to teach the step of computing the ratio of the two spherical summation values. The sections referred to be the Examiner in the office action as teaching this limitation actually teach the segmentation of the walls of the structure from the surrounding air and body tissue (Col. 6, lines 41-53) and not for the *detection* of abnormalities in the digital imagery. In the claimed invention, segmentation occurs before the detection of abnormalities and involves different computations.

Further, the Examiner admits Vining fails to teach comparing the ratio to a threshold value and creating a set of detection images by turning voxels ON which exceed the threshold value and cites Summers. However, Summers fails to remedy the deficiencies of Vining. Summers discloses feature extraction and identification in CT bronchoscopy medical imagery. However, Summers also fails to disclose calculating the ratio of two spherical summations, wherein the spherical summations use two different radii, in order to *detect* abnormalities in the digital imagery. The sections refer to by the Examiner in the office action as teaching this limitation, in point of fact, disclose the *segmentation* of the medical images to prevent segmentation leakage not for the *detection* of abnormalities in the digital imagery (Col. 7, line 66 through Col. 8, line 31). As mentioned above, in the claimed invention, segmentation occurs before the detection of abnormalities. Further, Summers refers to curvature analysis and the use of partial derivatives to detect lesions in the imagery (Abstract; Col. 5, lines 5-9; Col. 16, line 52 through Col. 20, line 8). As discussed above, the claimed invention recites using simple summation for detection and specifically teaches away from using curvature calculations and derivative processes. Therefore, neither Vining nor Summers disclose the limitations in the

claimed invention.

Nor does the hypothetical combination of Vining and Summers suggest or teach calculating the ratio of two different spherical summation operations, wherein the spherical summations use two different radii, in order to detect abnormalities in the digital imagery. Because the hypothetical combination of Vining and Summers does not suggest or teach all the limitations of the claimed invention, Applicant believes that claim 1 is patentable over the prior art and request the Examiner withdraw his rejection to claim 1.

Independent claim 10 also recite calculating the ratio of two different spherical summation operations, wherein the spherical summations use two different radii, in order to *detect* abnormalities in the digital imagery as called for in claim 1. Therefore, for the same reasons discussed above, Applicant believes claim 10 is also patentable over the prior art and request the Examiner withdraw his rejection to claim 10.

Claims 2-8 and 11-20 depend from the independent claims 1 and 10 either directly or ultimately. These dependent claims are patentable for the same reasons as presented above with respect to the claims from which they depend. Further, the dependent claims also include additional limitations which distinguish them from the prior art. For example, claims 2 and 11 recite that the first spherical operation is performed over a spherical region of a first radius and the second spherical operation is performed over a spherical region of a second radius less than the first radius, a limitation not disclosed by either Vining or Summers. Therefore, Applicant asserts that claims 2-8 and 11-20 are also patentable over the prior art and requests that the Examiner withdraw his rejection thereof.

#### CONCLUSION

For the above reasons, the Applicant respectfully submits that the above claims represent allowable subject matter. The Examiner is encouraged to contact the undersigned to resolve efficiently any formal matters or to discuss any aspects of the application or of this response. Otherwise, early notification of allowable subject matter is respectfully solicited.

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